

2003-0013/N1085-170

**REMARKS**

1. Claims 18-33 are pending in the application. Of these claims, claims 18, 23, 24, 29, 30, and 33 stand rejected and claims 19-22, 25-28, 31, and 32 stand objected to.

Reconsideration of this application is respectfully requested.

2. It is gratefully noted that the Examiner has indicated that objected to claims 19-22, 25-28, 31, and 32 contain allowable subject matter.

3. Claim 18 stands rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,812,120 to Young et al. (Young) in combination with U.S. Patent 6,130,453 to Mei et al. (Mei). This rejection is respectfully traversed.

Claim 18 is directed to a method of making a flash memory cell comprising a floating gate with corners each having a sharp, upwardly flared shape, and requires:

providing a substrate of semiconductor material;

forming a mask film over the substrate;

defining a trench in the mask film, the trench terminating above the substrate;

at least partially filling the trench with a first film of electroconductive material; and

etching back a portion of the first film of electroconductive material to form the floating gate with the sharp, upwardly flared corners.

In support of the rejection using Young and Mei, the Examiner states,

"Mei et al. teach forming a floating gate above the substrate to reduce cell size of split gate flash memory cells. See column 1, lines 30-40. It would have been obvious to one of ordinary skill in the art of making semiconductor devices to form the trench above the substrate to allow forming the floating gate above the substrate in the process of Young et al. to obtain the above benefit."

The mere fact that references can be combined or modified does not render the resulting combination obvious unless the prior art also suggests the desirability of the combination. *In re*

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*Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). It is respectfully submitted that the subject matter of claim 18 would not have been obvious in light of the combined teachings of Young and Mei because it would not have been obvious to form the trench in Young above the substrate as allegedly taught by Mei, so as to allow the floating gate to be formed above the substrate, because Young and Mei both teach that it is undesirable to form the floating gate above the substrate.

Although the background section of Mei states that the cell size of split gate flash memory cells can be reduced by building the floating gate and bit line vertically above the substrate surface, Mei also states in column 1, lines 44-48 that doing so requires a relatively large surface topography to accommodate the upward vertical split floating gate structure and thus, this structure makes the manufacture of the flash memory cell relatively difficult and complex. Mei avoids this problem by disclosing a flash memory structure wherein the floating gate is built in a trench below the surface of the substrate. Hence, Mei actually teaches away from forming the floating gate above the surface of the substrate.

Young also teaches away from forming the floating gate above the substrate in column 1, line 67 through column 2, line 19 referencing FIGS 1 and 2,

Conventionally, several methods for improving the shape of the corner of the floating gate are provided, for example, one such method is being disclosed in the U.S. Pat. No. 6,429,075. Referring to FIG. 1 and FIG. 2, a conventional memory device including a first isolation layer 20, a substrate 12, a floating gate 22 and a second isolation layer 26 is provided. The first isolation layer 20 is disposed over the substrate 12, the floating gate 22 is disposed over the first isolation layer 20, and the second isolation layer 26 is disposed over the floating gate 22. Next, a thermal oxidation process is performed under a temperature of about 800.degree. C. to 900.degree. C. to form a silicon oxide layer 27, and as shown in FIG. 2, a sharp corner 29 is formed on a corner of both side of the floating gate 22. However, since the temperature of the thermal oxidation process is performed at a high temperature, and therefore the thermal budget of the thermal process is high. Accordingly, the method described above is not ideal. Furthermore, in the process of forming trench of memory cells, the thermal oxidation process for growing the silicon oxide layer cannot be easily controlled.

In view of the teachings of both Young and Mei, there is no motivation for modifying Young's method so that the trench is formed above the substrate to allow the floating gate to be

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formed above the substrate, as proposed by the Examiner. Consequently, claim 18 is allowable over Young in combination with Mei.

In view of the foregoing, withdrawal of this rejection is respectfully urged.

4. Claims 23, 24, 29, 30, and 33 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Young in combination with Mei, as applied to claim 18, and further in view of U.S. Patent Publication 2005/1045920 to Chang et al. (Chang) and U.S. Patent 6,569,736 to Hsu et al. (Hsu). This rejection is respectfully traversed.

As discussed above, there is no motivation for modifying Young's method so that the trench is formed above the substrate to allow the floating gate to be formed above the substrate, as proposed by the Examiner. Consequently, claim 18 is allowable over Young in combination with Mei.

Chang and Hsu fail to cure the deficiencies of Young in combination with Mei. Specifically, Chang appears to describe forming trenches that extend into and terminate within the substrate.

The Hsu patent appears to describe forming a trench in a mask film 38 that has been formed over a film of electroconductive material 36 that covers a substrate, and then filling the trench with an insulating material 46. Although the trench does not extend into the substrate, the trench is formed after the electroconductive material has been deposited over the substrate. In contrast, claim 18 requires "at least partially filling the trench with a first film of electroconductive material." No electroconductive material is used to fill the trench in Hsu, moreover, there is no suggestion in the cited prior art of record to do so. Accordingly, Young in combination with Mei, further in view of Chang and Hsu, fail to arrive at the invention of claim 18.

Claims 23, 24, 29, 30, and 33, which depend from claim 18 and recite additional features of the invention, are allowable over Young in combination with Mei and further in view of Chang and Hsu for at least the same reasons, as stated for claim 18.

In view of the foregoing, withdrawal of this rejection is respectfully urged.

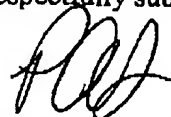
5. Favorable reconsideration of this application is respectfully requested as it is believed that all outstanding issues have been addressed herein and, further, that claims 18-33 are in

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condition for allowance. Should there be any questions or matters whose resolution may be advanced by a telephone call, the examiner is cordially invited to contact applicants' undersigned attorney at his number listed below.

6. The Commissioner is hereby authorized to charge payment of any filing fees required under 37 CFR 1.16 and any patent application processing fees under 37 CFR 1.17, which are associated with this communication, or credit any overpayment to Deposit Account No. 04-1679.

Respectfully submitted,



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